0.1 Star Delta Transformation

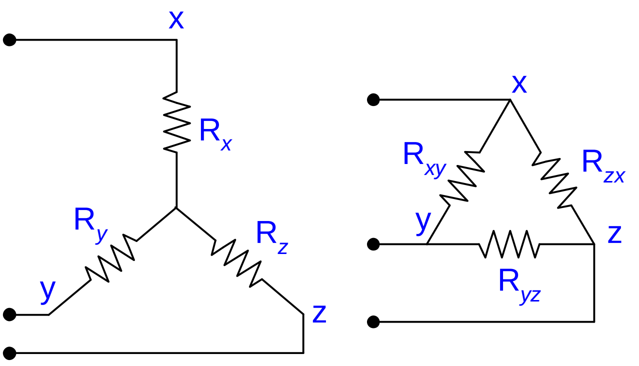

Figure 1

$$R_x + R_y = \frac{R_{xy}(R_{yz} + R_{zx})}{R_{xy} + R_{yz} + R_{zx}} \tag{1}$$

$$R_y + R_z = \frac{R_{yz}(R_{zx} + R_{xy})}{R_{xy} + R_{yz} + R_{zx}} \tag{2}$$

$$R_z + R_x = \frac{R_{zx}(R_{xy} + R_{yz})}{R_{xy} + R_{yz} + R_{zx}} \tag{3}$$

Equation (1)-(2)

$$R_x - R_z = \frac{R_{xy}R_{zx} - R_{yz}R_{zx}}{R_{xy} + R_{yz} + R_{zx}} \tag{4}$$

Equation (3)+(4)

$$2R_x = \frac{2R_{xy}R_{zx}}{R_{xy} + R_{yz} + R_{zx}}$$

$$R_x = \frac{R_{xy}R_{xz}}{R_{xy} + R_{yz} + R_{zx}} \tag{5}$$

Similarly

$$R_y = \frac{R_{yz}R_{yx}}{R_{xy} + R_{yz} + R_{zx}} \tag{6}$$

$$R_z = \frac{R_{zy}R_{zx}}{R_{xy} + R_{yz} + R_{zx}} \tag{7}$$

Star to Delta Transformation

$$R_xR_y = \frac{R^2{}_{xy}R_{xz}R_{yz}}{(\sum R_{xy})^2}$$

$$R_yR_z = \frac{R^2_{yz}R_{yx}R_{zx}}{(\sum R_{xy})^2}$$

$$R_zR_x = \frac{R^2_{zx}R_{yx}R_{yz}}{(\sum R_{xy})^2}$$

$$R_xR_y + R_yR_z + R_zR_x = \frac{R_{xy}R_{yz}R_{zx}(R_{xy} + R_{yz} + R_{zx})}{(\sum R_{xy})^2}$$

$$R_xR_y + R_yR_z + R_zR_x = \frac{R_{xy}R_{yz}R_{zx}(R_{xy} + R_{yz} + R_{zx})}{(\sum R_{xy})^2}$$

$$R_xR_y + R_yR_z + R_zR_x = \frac{R_{xy}R_{yz}}{\sum R_{yz}}R_{zx} = R_xR_{yz}$$

$$R_{yz} = \frac{R_xR_y + R_yR_z + R_zR_x}{R_x}$$

$$R_{yz} = R_y + R_z + \frac{R_yR_z}{R_x} \tag{8}$$

$$R_{xy} = R_x + R_y + \frac{R_xR_y}{R_z} \tag{9}$$

$$R_{zx} = R_z + R_x + \frac{R_zR_x}{R_y} \tag{10}$$

Q 1) 2020-Aug (2018 scheme ECE) 2020-Aug (2018 scheme EE) 2017-June Determine the Input resistance between PQ using star-delta transformation

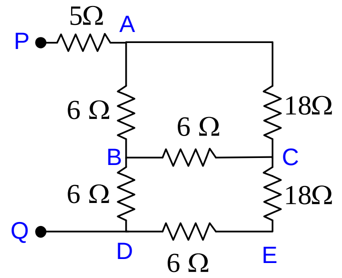

Figure 2

Solution:

In the given circuit 6 Ω, 6 Ω and 18 connected between A,B and C are in delta connection, convert this into star network. The details are as shown in Figure 3

$$\begin{aligned} R_A &= \frac{R_{AB} \times R_{AC}}{\sum R_{AB}} \\ R_A &= \frac{6 \times 18}{30} = 3.6\Omega \\ R_B &= \frac{6 \times 6}{30} = 1.2\Omega \\ R_C &= \frac{6 \times 18}{30} = 3.6\Omega \end{aligned}$$

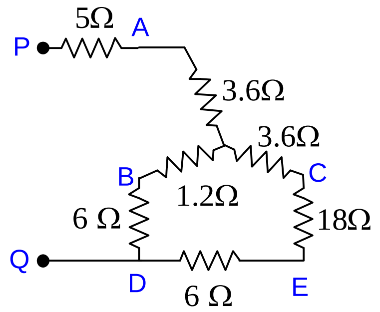

Figure 3

In the circuit 5 Ω and 3.6 Ω are in series, 6 Ω and 1.2 Ω are in series and 3.6 Ω 18 Ω and 6 Ω are in series.

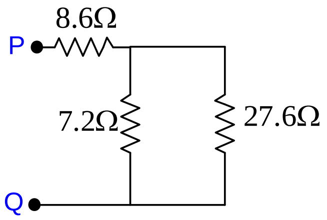

Figure 4

7.2 Ω 27.6 Ω are in parallel, which is in series with 8.6 Ω. The net resistance is.

$$\begin{aligned} R_{PQ} &= 8.6 + \frac{7.2 \times 27.6}{7.2 + 27.6} \\ &= 8.6 + 5.71 \\ &= 14.31\Omega \end{aligned}$$

Q 2) For the circuit shown in Figure shown in Figure 5 determine the equivalent resistance between any two terminals.

Solution:

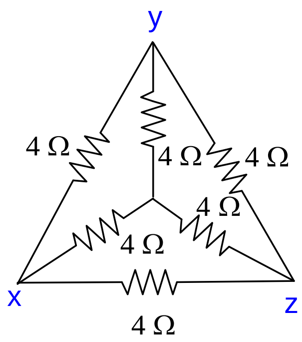

Figure 5

Solution:

In the given $4, 4, 4,$ *and* Ω are in star network, convert this star network to delta network

$$\begin{aligned} R_{xy} &= R_x + R_y + \frac{R_x \times R_y}{R_z} = 8 + 4 = 12\Omega \\ R_{xy} &= 4 + 4 + \frac{4 \times 4}{4} = 8 + 4 = 12\Omega \\ R_{yz} &= 4 + 4 + \frac{4 \times 4}{4} = 8 + 4 = 12\Omega \\ R_{zx} &= 4 + 4 + \frac{4 \times 4}{4} = 8 + 4 = 12\Omega \end{aligned}$$

As shown in the Figure 6, by looking by any two terminals 12 Ω is parallel with 4 Ω

$$= \frac{12 \times 4}{12 + 4} = 3\Omega$$

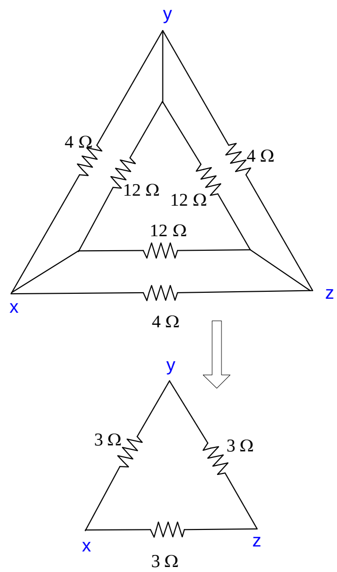

Figure 6

By looking from XZ terminal the 3 Ω resistance is in parallel with series connection of 3 Ω and 3 Ω resistance.

$$R_{XZ} = \frac{3 \times 6}{3 + 6} = 2\Omega$$

Q 3) For the circuit shown in Figure shown in Figure 7 determine the equivalent resistance between (1)A and B and (2) A and N.

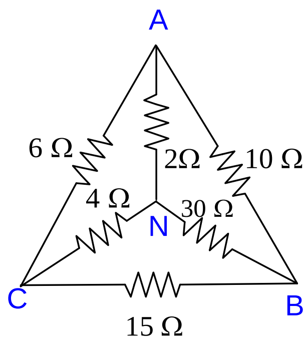

Figure 7

Solution:

Convert the internal star network to delta network

$$
\begin{aligned}
R_{AB} &= R_A + R_B + \frac{R_A R_B}{R_C} \\
R_{AB} &= 2 + 30 + \frac{2\times 30}{4} = 32 + 15 = 47\Omega \\
R_{BC} &= 4 + 30 + \frac{4\times 30}{2} = 34 + 60 = 94\Omega \\
R_{CA} &= 4 + 2 + \frac{4\times 2}{30} = 6 + 0.266 = 6.266\Omega
\end{aligned}
$$

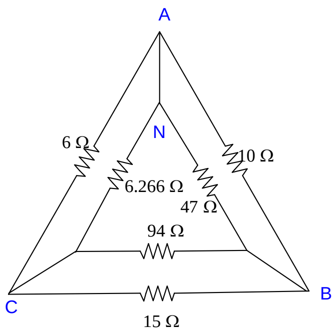

Figure 8

In the circuit 10 Ω is parallel with 47 Ω

$$= \frac{10\times 47}{10+47} = 8.245\Omega$$

Similarly 94 Ω is parallel with 15 Ω

$$= \frac{94\times 15}{94+15} = 12.93\Omega$$

Similarly 6 Ω is parallel with 6.266 Ω

$$= \frac{6\times 6.266}{6+6.266} = 3.06\Omega$$

The details are as shown in Figure **??**

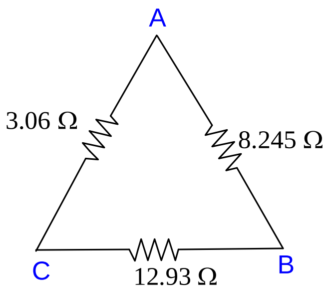

Figure 9

While looking from terminal AB the resistances 12.93 and Ω and 3.06 Ω are in series and this resistance is parallel with 8.245 Ω

$$= 12.93 + 3.06 = 16\Omega$$

$$R_{AB} = \frac{8.245\times 16}{8.245+16} = 5.44\Omega$$

(ii)The resistance between A and N is

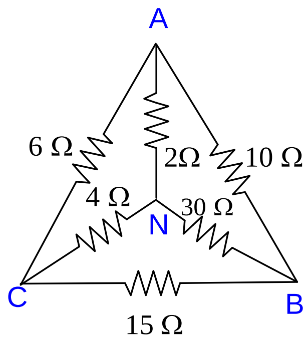

Figure 10

From the Figure 10 by looking from the terminal resistance between A and N, there is a delta network between NCB which is replaced by star network.

$$
\begin{aligned}
R_x &= \frac{R_{xy}R_{xz}}{R_{xy}+R_{yz}+R_{zx}} \\
R_B &= \frac{30\times 15}{30+15+4} = 9.18 \\
R_C &= \frac{4\times 15}{30+15+4} = 1.225 \\
R_N &= \frac{30\times 4}{30+15+4} = 2.5
\end{aligned}
$$

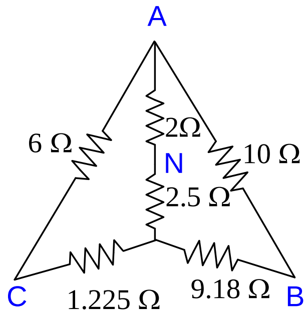

Figure 11

In the network of 6 Ω and 1.225 Ω are in series, 10 Ωand 9.18 Ω are in series. The details are as shown in Figure 12

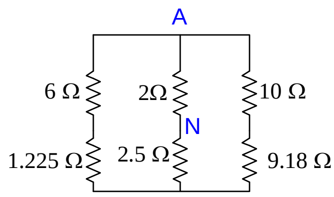

Figure 12

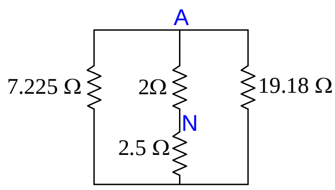

Figure 13

The resistances 7.225 Ω and 19.18 Ω are in parallel

$$= \frac{7.225 \times 19.18}{7.225 \times 19.18} = 5.25\Omega$$

The details are as shown in Figure 14

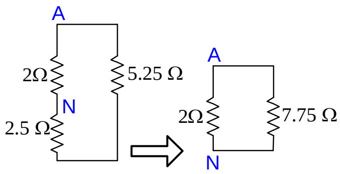

Figure 14

The resistances 2.5 Ω and 5.25 Ω are in series. The resistances 2 Ω 7.75 Ω are in in parallel and the net resistance between A and N is

$$= \frac{2 \times 7.75}{2 + 7.75} = 1.59\Omega$$

Q 4) Determine the equivalent resistance between terminals A and B

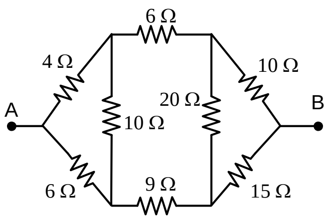

Figure 15

Solution:

$$\begin{aligned} R_A &= \frac{4 \times 6}{20} = 1.2\Omega \\ R_B &= \frac{4 \times 10}{20} = 2\Omega \\ R_C &= \frac{6 \times 10}{20} = 3\Omega \end{aligned}$$

$$\begin{aligned} R_A &= \frac{10 \times 15}{45} = 3.33\Omega \\ R_B &= \frac{10 \times 20}{45} = 4.44\Omega \\ R_C &= \frac{20 \times 15}{45} = 6.667\Omega \end{aligned}$$

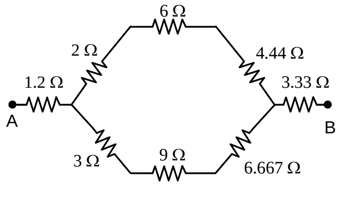

Figure 16

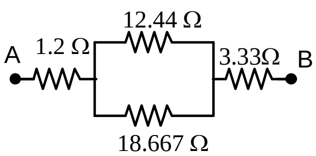

Figure 17

$$\begin{aligned} R_{AB} &= 1.2 + \frac{12.44 \times 18.667}{12.44 + 18.667} + 3.3\Omega \\ &= 1.2 + \frac{232.217}{12.44 + 31.187} + 3.3\Omega \\ &= 1.2 + 7.446 + 3.3 = 11.94\Omega \end{aligned}$$

Q 5) 2018-Dec (2010 scheme) Find the resistance of the circuit shown in Figure shown in Figure 5 between A and B

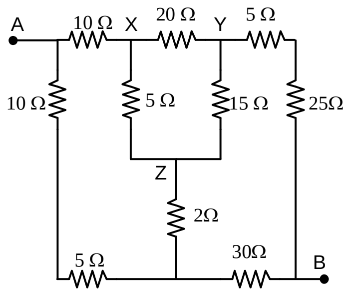

Figure 18

Solution:

In the given network 18 there is delta network between xyz and it is replaced by star network.

$$\begin{aligned} R_X &= \frac{20 \times 5}{40} = 2.5\Omega \\ R_Y &= \frac{20 \times 15}{40} = 7.5\Omega \\ R_Z &= \frac{15 \times 5}{40} = 1.875\Omega \end{aligned}$$

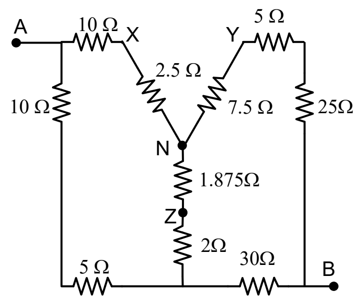

Figure 19

In the circuit 19, 10 Ω 2.5 Ω are in series, similarly 5 Ω 7.5 Ω are in series. The details are as shown in Figure 20

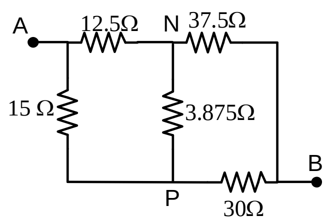

Figure 20

In the circuit 20 at NPB 37.5 Ω 3.875 Ω and 30 are in delta connection, convert into star network. The details are as shown in Figure 21

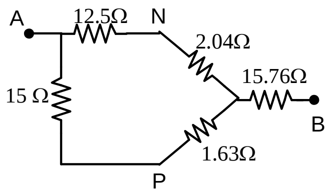

Figure 21

In the circuit 21, 12.5 Ω, 2.045 Ω are in series, similarly 1.635 Ω 15 Ω are in series. The details are as shown in Figure 22

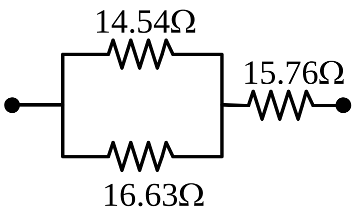

Figure 22

In the circuit 22 14.54 Ω, 16.63 Ω are in parallel, which is in series with similarly 15.76 Ω. The net resistance between AB is.

$$
\begin{aligned}
R_{AB} &= 15.76 + \frac{14.54 \times 16.63}{14.54 + 16.63} \\
&= 15.76 + 7.76 \\
&= 23.52\Omega
\end{aligned}
$$

Q 6) For the circuit shown in Figure shown in Figure 5 determine the current i using star delta transformation.

Solution:

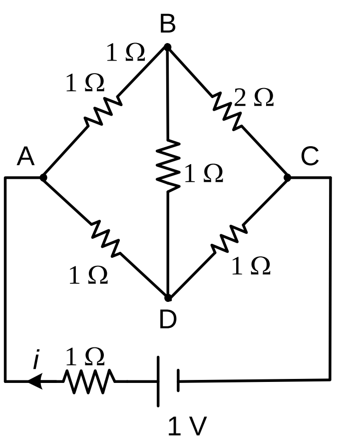

Figure 23

As shown in Figure 23 there is delta network between ABC, convert this to star network

$$
\begin{aligned}
R_A &= \frac{1 \times 1}{1+1+1} = 0.333\Omega \\
R_B &= \frac{1 \times 1}{1+1+1} = 0.333\Omega \\
R_C &= \frac{1 \times 1}{1+1+1} = 0.333\Omega
\end{aligned}
$$

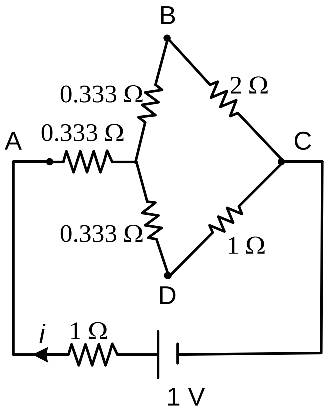

Figure 24

The resistances 0.333 Ω and 2 Ω are in series and 0.333 Ω and 1 Ω are in series.

The resistances 2.333 Ω and 1.333 Ω are in parallel its equivalent resistance is

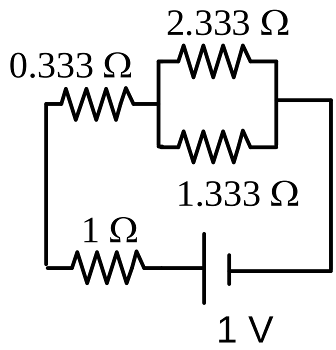

Figure 25

$$
= \frac{2.333 \times 1.333}{2.333 + 1.333} = \frac{3.109}{3.666} = 0.848\Omega
$$

Total network resistance is 1+0.333+0.848=2.181Ω

$$
I = \frac{1}{2.181} = 0.458A
$$

Q 7) Calculate the current in the 40 Ω resistance of the circuit shown in Figure shown in Figure 5 using star delta transformation.

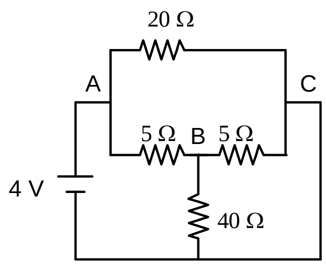

Figure 26

Solution:

As shown in Figure 23 there is delta network between ABC, convert this to star network

$$R_A = \frac{20 \times 5}{30} = 3.333\Omega$$
$$R_B = \frac{5 \times 5}{30} = 0.833\Omega$$
$$R_C = \frac{20 \times 5}{30} = 3.333\Omega$$

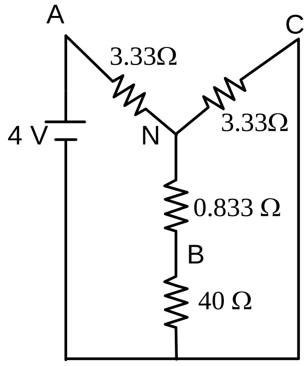

Figure 27

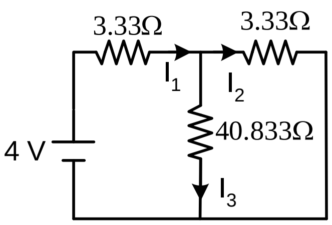

Figure 28

The total resistance of the network is

$$= 3.333 + \frac{40.833 \times 3.333}{40.833 + 3.333} = 3.333\Omega$$
$$= 3.333 + \frac{136}{44.163} = 3.333 + 3.08 + \Omega$$
$$= 6.41\Omega$$

The total current flowing in the network is

$$I_1 = \frac{4}{6.41} = 0.624A$$

Using branch current division method the current in 40 Ω is

$$I_3 = 0.624A\frac{3.333}{44.163} = 0.047A$$

Q 8) Determine the currents supplied by the each battery using star-delta transformation

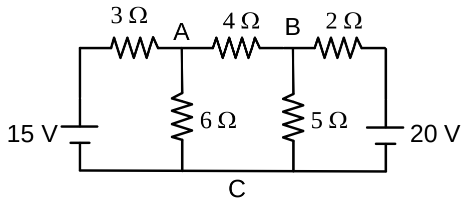

Figure 29

Solution:

As shown in Figure 29 there is delta network between ABC, convert this to star network

$$R_A = \frac{4 \times 6}{15} = 1.6\Omega$$
$$R_B = \frac{4 \times 5}{15} = 1.3\Omega$$
$$R_C = \frac{6 \times 5}{15} = 2\Omega$$

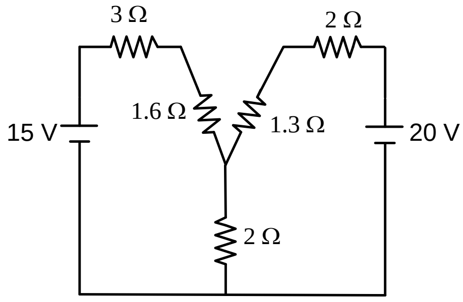

Figure 30

In the circuit 30, 3 Ω and 1.6 Ω are in series and also 2 Ω and 1.3 Ω are in series. The details are as shown in Figure 31

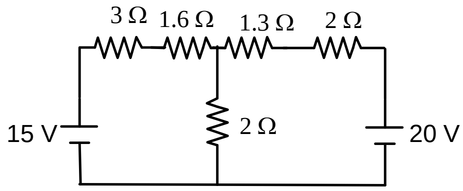

Figure 31

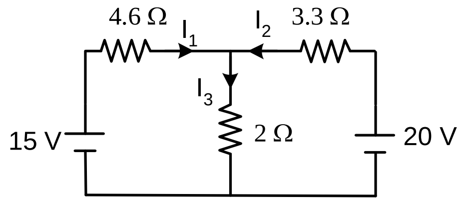

Figure 32

$$I_3 = I_1 + I_2$$

KVL for loop 1

$$15 - 4.6I_1 - 2I_3 = 0$$
$$15 - 4.6I_1 - 2I_1 - 2I_2 = 0$$
$$15 - 6.6I_1 - 2I_2 = 0$$
$$6.6I_1 + 2I_2 = 15$$

KVL for loop 2

$$20 - 3.3I_2 - 2I_3 = 0$$
$$20 - 3.3I_2 - 2I_1 - 2I_2 = 0$$
$$20 - 5.3I_2 - 2I_1 = 0$$
$$2I_1 + 5.3I_2 = 20$$

Simultaneous equations are

$$6.6I_1 + 2I_2 = 15 \quad (11)$$

$$2I_1 + 5.3I_2 = 20 \quad (12)$$

$$\Delta = \begin{vmatrix} 6.6 & 2 \\ 2 & 5.3 \end{vmatrix} = 6.6 \times 5.3 - (2 \times 2) = 34.98 - 4$$

=30.98

$$i_1 = \frac{\begin{vmatrix} 15 & 2 \\ 20 & 5.3 \end{vmatrix}}{\Delta} = \frac{79.5 - 40}{32.96} = \frac{39.5}{30.98} = 1.275A$$

$$i_2 = \frac{\begin{vmatrix} 6.6 & 15 \\ 2 & 20 \end{vmatrix}}{\Delta} = \frac{132 - 30}{30.98} = \frac{102}{30.98} = 3.292A$$

The current supplied by each battery are 1.275A and 3.292A respectively

9). Find the equivalent resistance between A and B as shown in Figure 33

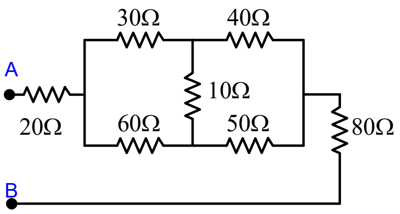

Figure 33

Solution:

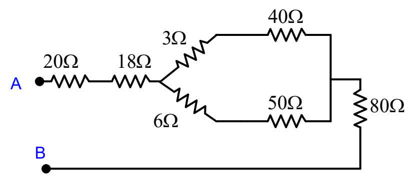

Figure 34

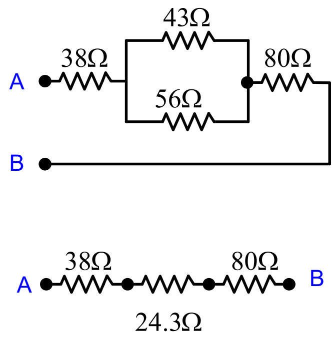

Figure 35

$$\begin{aligned} R_{AB} &= 1.87 + \frac{6.94 \times 3.55}{6.94 \times 3.55} \\ &= 38 + 24.3 + 80 = 142.3\Omega \end{aligned}$$

0.2 Question Papers

Question Papers

2019-Jan (2017 scheme ECE) Find the equivalent resistance between a and b as shown in Figure 36 using star delta transformation

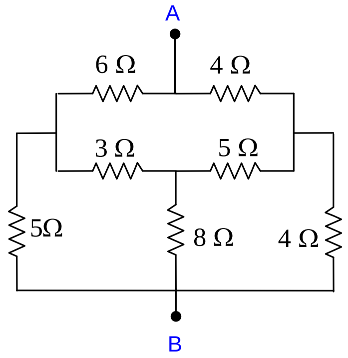

Figure 36: JAN-2019-Question Paper

Solution:

As shown in Figure 36 there is delta network between 8Ω 5Ω and 4 Ω, convert this to star network

$$R_A = \frac{8 \times 5}{8+4+5} = 2.35\Omega$$
$$R_B = \frac{5 \times 4}{17} = 1.17\Omega$$
$$R_C = \frac{8 \times 4}{17} = 1.88\Omega$$

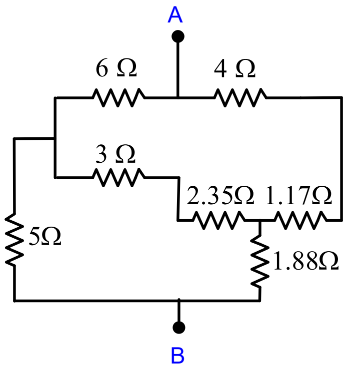

Figure 37

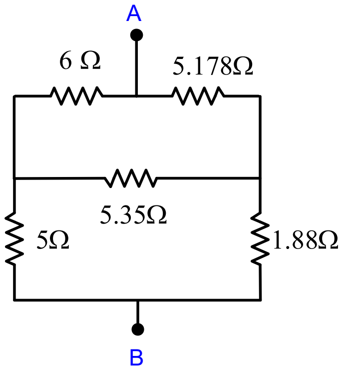

Figure 38

As shown in Figure 38 there is delta network between 6Ω 5.17Ω and 5.35 Ω, convert this to star network

$$R_A = \frac{6 \times 5.17}{6+5.17+5.35} = 1.87\Omega$$
$$R_B = \frac{5.17 \times 5.35}{16.52} = 1.67\Omega$$
$$R_C = \frac{6 \times 5.35}{16.52} = 1.94\Omega$$

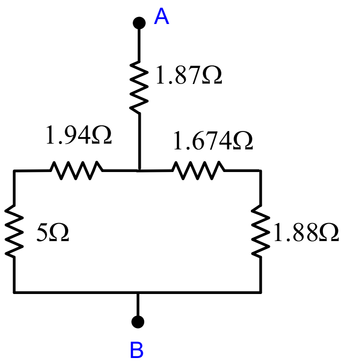

Figure 39

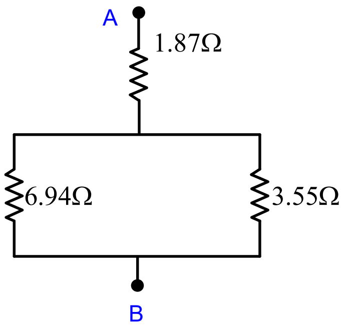

Figure 40

$$\begin{aligned} R_{AB} &= 1.87 + \frac{6.94 \times 3.55}{6.94 \times 3.55} \\ &= 1.87 + 2.34 = 4.21\Omega \end{aligned}$$

2019-DEC Determine the resistance between A and B of the network shown in Figure 41.

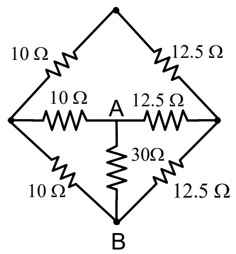

Figure 41: 2019-DEC

Solution:

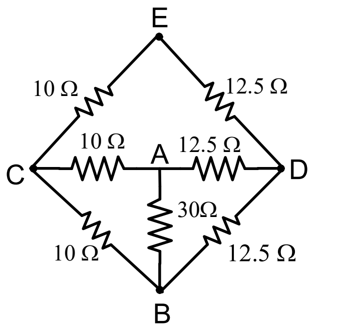

Figure 42

As shown in Figure 42 there is delta network between 2Ω 3Ω and 6 Ω, convert this to star network

$$
\begin{aligned}
R_A &= \frac{10 \times 30}{10+10+30} = 6\Omega \\
R_B &= \frac{10 \times 30}{50} = 6\Omega \\
R_C &= \frac{10 \times 10}{50} = 2
\end{aligned}
$$

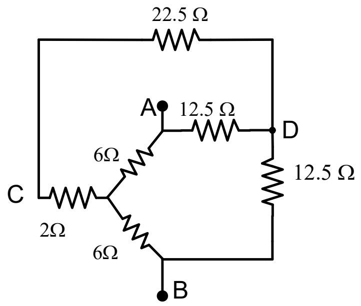

Figure 43

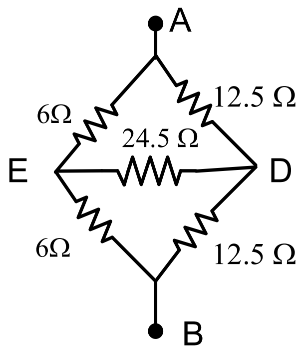

Figure 44

As shown in Figure 44 there is delta network between 6Ω 12.5Ω and 24.5 Ω, convert this to star network

$$
\begin{aligned}
R_A &= \frac{6 \times 12.5}{6+12.5+24.5} = 1.74\Omega \\
R_B &= \frac{6 \times 24.5}{43} = 3.41\Omega \\
R_C &= \frac{12.5 \times 24.5}{43} = 7.12\Omega
\end{aligned}
$$

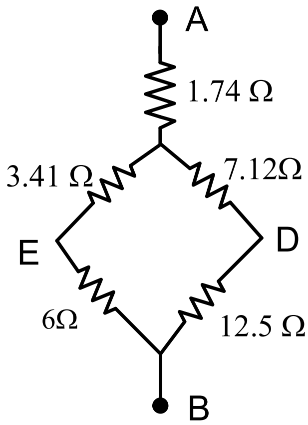

Figure 45

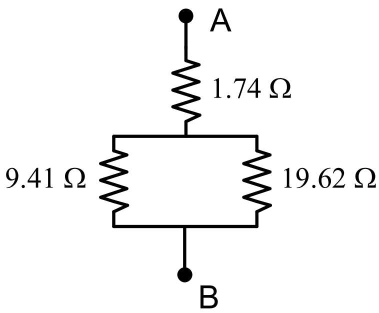

Figure 46

$$
\begin{aligned}
R_{AB} &= 1.74 + \frac{9.41 \times 19.62}{9.41 \times 19.62} = 1.74 + 6.36 \\
&= 8.1\Omega
\end{aligned}
$$

Also by observation its a wheatstone bridge because the ratio is

$$
\frac{12.5}{12.5} = \frac{6}{6} = 1
$$

Hence no current flows between E D

$$
R_{AB} = \frac{25 \times 12}{25 \times 12} = 8.1\Omega
$$

2019-DEC Determine the resistance between A and B of the network shown in Figure 41.

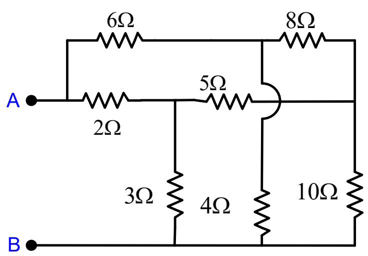

Figure 47: 2019-June-(2015-scheme-ECE)1

Solution:

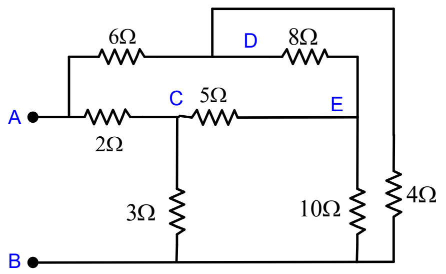

Figure 48

As shown in Figure 48 there is star network between 2Ω 3Ω and 5 Ω, convert this to star network

$$R_{AB} = 2+3+\frac{2\times 3}{5} = 5+1.2 = 6.2\Omega$$
$$R_{AE} = 2+5+\frac{2\times 5}{3} = 7+3.3 = 10.3\Omega$$
$$R_{BE} = 5+3+\frac{5\times 3}{2} = 8+7.5 = 15.5\Omega$$

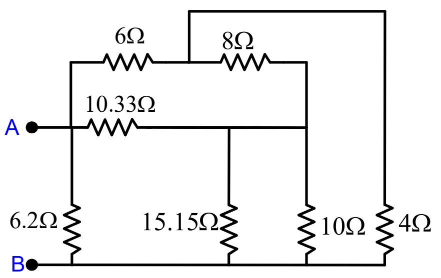

Figure 49

$$= \frac{10\times 15.5}{10\times 15.5} = 6.07\Omega$$

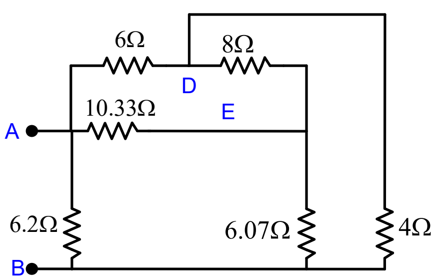

Figure 50

As shown in Figure 50 there is a delta network between 6.2Ω 10.33Ω and 6.07 Ω, convert this to star network

$$R_A = \frac{6.2\times 10.33}{6.2+10.33+6.07} = 2.83\Omega$$
$$R_B = \frac{6.2\times 6.07}{22.6} = 1.67\Omega$$
$$R_E = \frac{6.07\times 10.33}{22.6} = 2.77\Omega$$

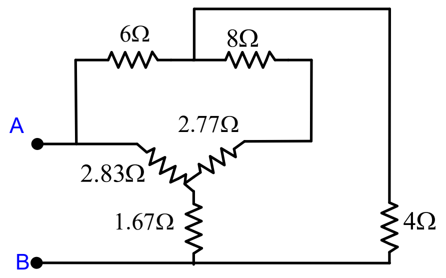

Figure 51

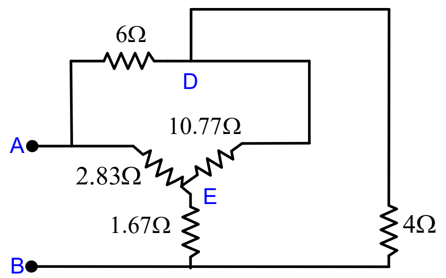

Figure 52

As shown in Figure 52 there is a delta network between 2.83Ω 6Ω and 10.77Ω, convert this to star network

$$R_A = \frac{2.83\times 6}{19.6} = 0.87\Omega$$
$$R_E = \frac{2.83\times 10.77}{19.6} = 1.55$$
$$R_D = \frac{10.77\times 6}{19.6} = 3.3$$

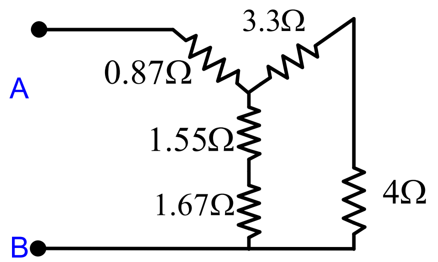

Figure 53

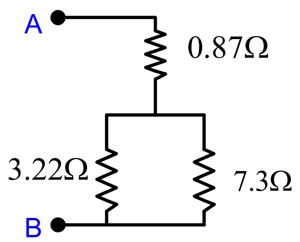

Figure 54

$$= 0.87+\frac{3.22\times 7.3}{3.22+7.3} = 0.87+2.23$$
$$= 3.1\Omega$$

2018-Dec,2014-Dec Using star/delta transformation determine the resistance between M and N of the network shown in Figure 55.

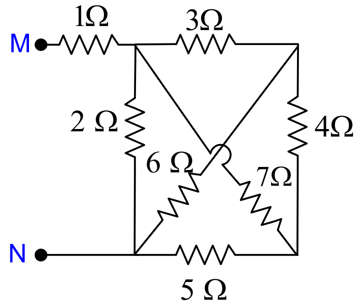

Figure 55: 2018-DEC-(2015-scheme-ECE)1

Solution:

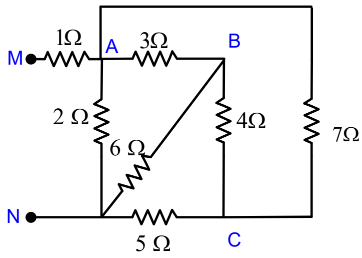

Figure 56

As shown in Figure 56 there is delta network between 2Ω 3Ω and 6 Ω, convert this to star network

$$R_A = \frac{2\times 3}{2+3+6} = 0.545\Omega$$
$$R_B = \frac{3\times 6}{11} = 1.636\Omega$$
$$R_C = \frac{6\times 2}{11} = 1.1\Omega$$

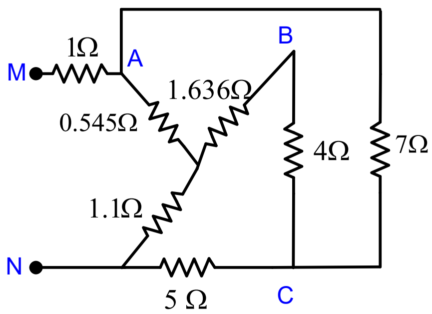

Figure 57

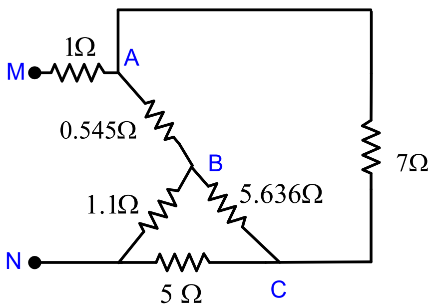

Figure 58

As shown in Figure 59 there is delta network between 1.1Ω 5.636Ω and 5 Ω, convert this to star network

$$R_B = \frac{1.1\times 5.636}{11.736} = 0.528\Omega$$
$$R_N = \frac{1.1\times 5}{11.736} = 0.468\Omega$$
$$R_C = \frac{5.636\times 5}{11.736} = 2.4\Omega$$

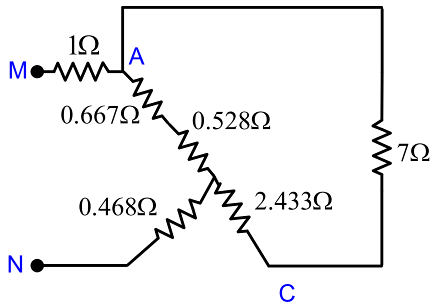

Figure 59

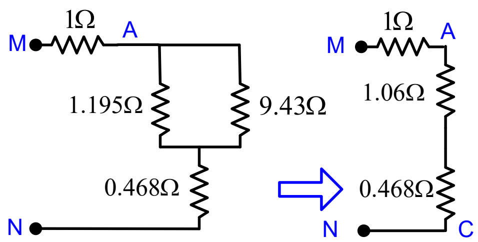

Figure 60

$$R_B = \frac{1.195\times 9.43}{1.195+9.43} = 1.06\Omega$$

$$R_{MN} = 1+1.06+0.468 = 2.528\Omega$$

2015-Dec Find the equivalent resistance between A and B of the network shown in Figure 61 using Star-Delta transformation.

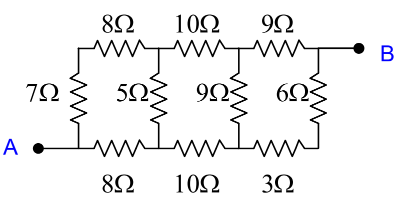

Figure 61: 2015-DEC

Solution:

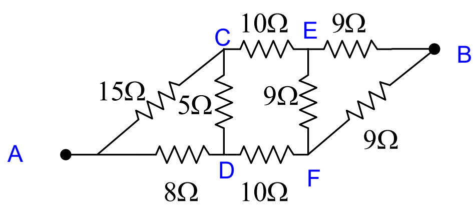

Figure 62

As shown in Figure 62 there is delta network between 15Ω 8Ω and 5 Ω, and there is delta network between 9Ω 9Ω and 9 Ω, convert this to star network

$$R_A = \frac{15\times 8}{28} = 4.28\Omega$$
$$R_D = \frac{5\times 8}{28} = 1.42\Omega$$
$$R_C = \frac{15\times 5}{28} = 2.67\Omega$$
$$R_B = \frac{9\times 9}{27} = 3\Omega$$
$$R_E = \frac{9\times 9}{27} = 3\Omega$$
$$R_F = \frac{9\times 9}{27} = 3\Omega$$

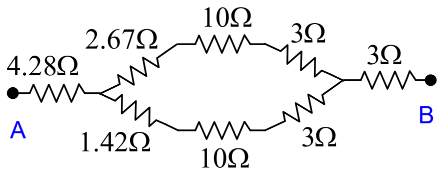

Figure 63

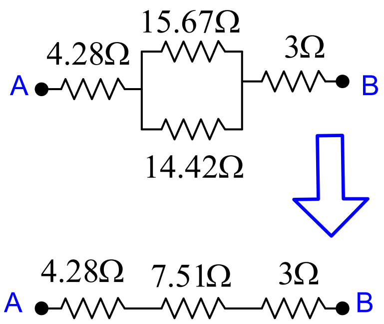

Figure 64

15.67 and 14.42 Ω are in parallel

$$= \frac{15.67\times 14.42}{15.67\times 14.42} = 7.51\Omega$$

$$R_{AB} = 4.28 + 7.51 + 3 = 14.79\Omega$$

2013-DEC1 Using star/delta transformation determine the resistance between M and N of the network shown in Figure 65.

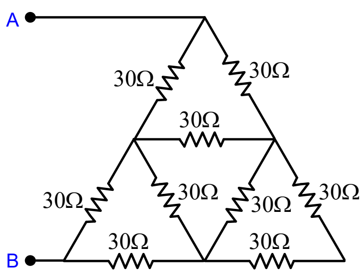

Figure 65: 2013-DEC1

Solution:

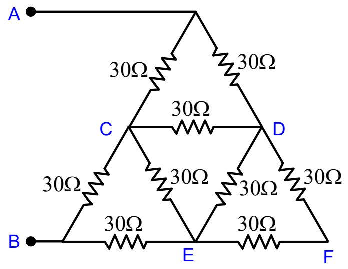

Figure 66: 2013-DEC1

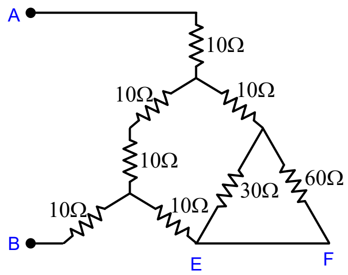

Figure 67: 2013-DEC1

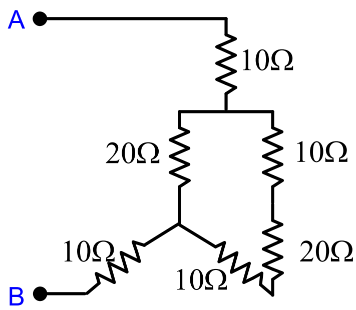

Figure 68: 2013-DEC1

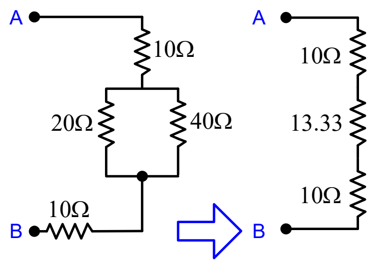

Figure 69: 2013-DEC1

2008-June Using star/delta transformation determine the resistance between M and N of the network shown in Figure 70.

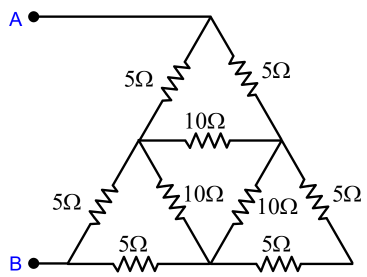

Figure 70: 2008-June

Solution:

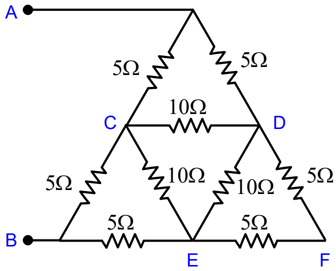

Figure 71: 2008-June

As shown in Figure 71 there is delta network between A C D 5Ω 5Ω and 10 Ω, and there is delta network between B C E 5Ω 5Ω and 10 Ω, convert this to star network

$$R_A = \frac{5\times 5}{20} = 1.25\Omega$$
$$R_C = \frac{5\times 10}{20} = 2.5\Omega$$
$$R_D = \frac{5\times 10}{20} = 2.5\Omega$$
$$R_B = \frac{5\times 5}{20} = 1.25\Omega$$
$$R_E = \frac{5\times 10}{20} = 2.5\Omega$$
$$R_F = \frac{5\times 10}{20} = 2.5\Omega$$

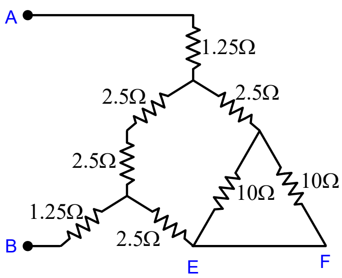

Figure 72: 2008-June22

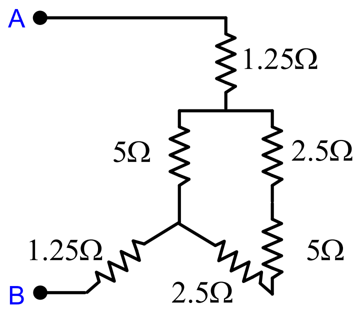

Figure 73: 2008-June23

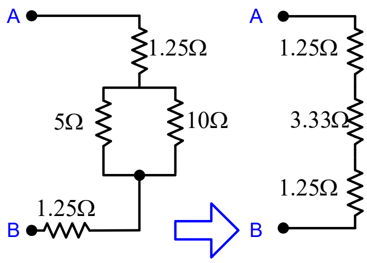

Figure 74: 2008-June24

$$\begin{aligned} R_{AB} &= 1.25 + 3.33 + 1.25 \\ &= 5.83\Omega \end{aligned}$$

2007-July Using star/delta transformation determine the resistance between A and B of the network shown in Figure 75.

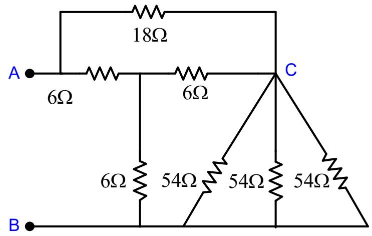

Figure 75: 2007-July

Solution:

As shown in Figure 75 there is star network between 6Ω 6Ω and 6 Ω, convert this to star to delta network

$$R_{AB} = 6 + 6 + \frac{6\times 6}{6} = 12 + 6 = 18\Omega$$
$$R_{AC} = 6 + 6 + \frac{6\times 6}{6} = 12 + 6 = 18\Omega$$
$$R_{BC} = 6 + 6 + \frac{6\times 6}{6} = 12 + 6 = 18\Omega$$

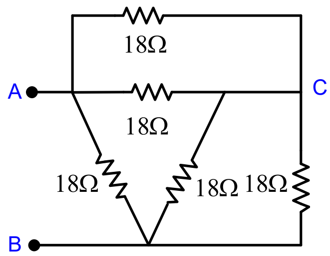

Figure 76: 2007-July

18 Ω between AC and AB are in parallel

$$= \frac{18\times 18}{36} = 9\Omega$$

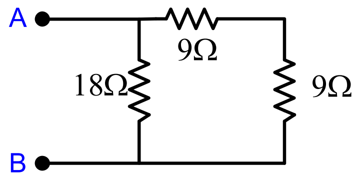

Figure 77: 2007-July

9Ω and 9Ω are in series which is in parallel with 18 Ω

$$AB = 18 + \frac{9\times 9}{18} = 18 + 4.5 = 22.5\Omega$$

Using star/delta transformation determine the resistance between A and B of the network shown in Figure 78.

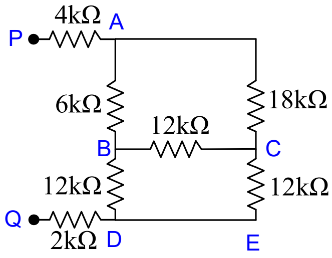

Figure 78

Solution:

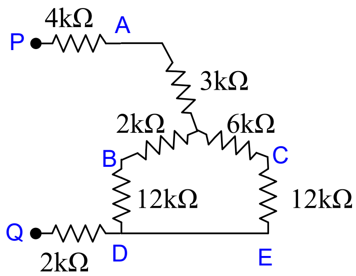

Figure 79

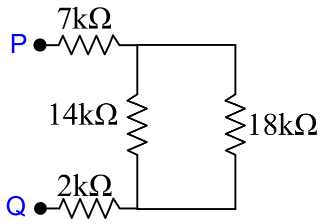

Figure 80

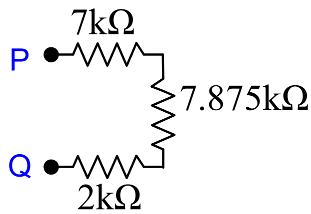

Figure 81

$$R_{PQ} \quad = \quad 7 + 7.785 + 2 = 16.785k\Omega$$